Measurement of the Partial $0^+ \varnothing 0^+$ Half Life of ^{10}C with GAMMASPHERE

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The u-d element (V_{ud}) of the Cabibbo-Kobayashi-Maskawa (CKM) quark-mixing matrix is a fundamental parameter of the Standard Model of Electroweak Interactions. Its most precise determination comes from nuclear physics experiments, in particular, from measurements of superallowed Fermi beta decays. These measurements, requiring both precision nuclear physics experiments and state of the art theoretical nuclear physics calculations, have been made for a variety of nuclei ranging from ^{14}O to ^{54}Co. The u-d element obtained from these measurements is in statistical agreement and the average value obtained implies a non-unitary CKM matrix, which if correct, would require exotic extensions to the Standard Model. Unfortunately the theoretical calculations of the isospin breaking corrections, necessary for extracting V_{ud}, are controversial. For example, Wilkinson[1] has suggested that these calculations are incomplete and that the isospin breaking corrections must be extracted empirically. In order to resolve this controversy, much effort has recently been invested in measuring V_{ud} from the superallowed Fermi decay of ^{10}C, where the isospin breaking corrections are expected to be small and any residual charge dependent corrections will be apparent. This is a very challenging measurement, since the beta decay of ^{10}C has a small superallowed Fermi branching ratio, which has to be precisely determined in a high background environment.

We are currently engaged in series of experiments to measure the superallowed Fermi branching ratio of ^{10}C beta decay using the GAMMASPHERE facility at the LBNL 88-inch cyclotron. The first data run resulted in a branching ratio of $(1.4665\pm0.0038)\infty10^{-2}$[2]. A second a high statistics run was made in July 1997 and the analysis of this data is currently in progress. Partial analysis of this data results in a precision of results approximately $1.2\infty10^{-3}$ on the branching ratio. A manuscript describing the second measurement is currently being prepared.

Footnotes and References

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2. B. K. Fujikawa, *et al.*, Phys. Lett. **B449**, 6 (1999).

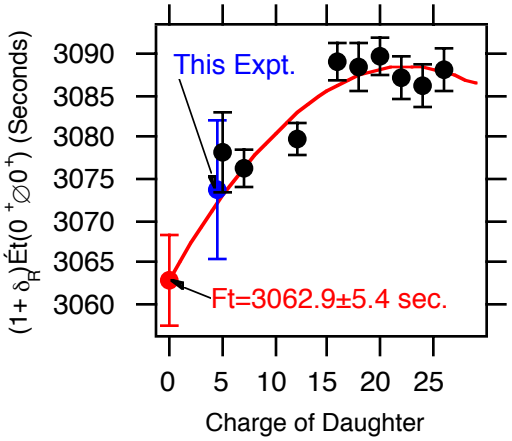

Fig. 1. The radiatively corrected Ét values for superallowed Fermi beta decays plotted against the charge of the daughter nucleus. The solid curve is a fit to the data assuming a hypothetical quadratic Z dependent isospin breaking correction proposed by Wilkinson[1]. Recent results from this experiment on ^{10}C, taken with previous experiments, tend to support such dependence.